

Groundwater Conditions in Agricultural Areas

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Central Coast Water Board

Introduction Summary

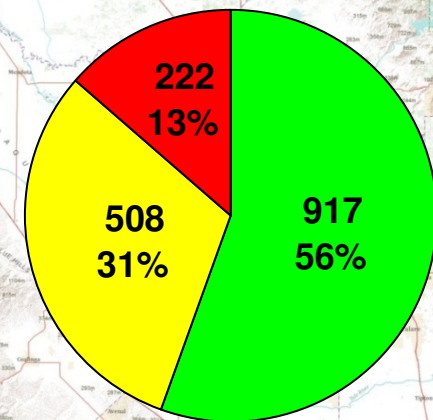
- Agricultural groundwater impacts
- Drinking water supplies and nitrate
- Nitrogen/nitrate loading and sources
- Costs
- Human health effects from nitrate
- Environmental Justice

Maximum Nitrate Concentrations in Public Water Supply Wells (≥ 15 connections) 1979 to 2009

Public Supply Wells Maximum Nitrate as NO_3 Concentrations in milligram per Liter (mg/L)

- <14 mg/L nitrate as NO_3 (not due to human activities*)
- 14 mg/L to 44 mg/L nitrate as NO_3
- ≥ 45 mg/L nitrate as NO_3 (maximum contaminant level)

Nitrate Distribution for Public Water Supply Wells (1,647 total)



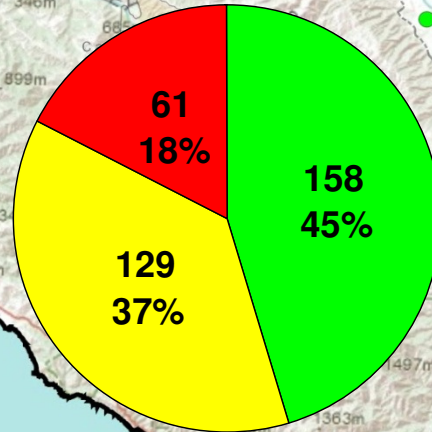
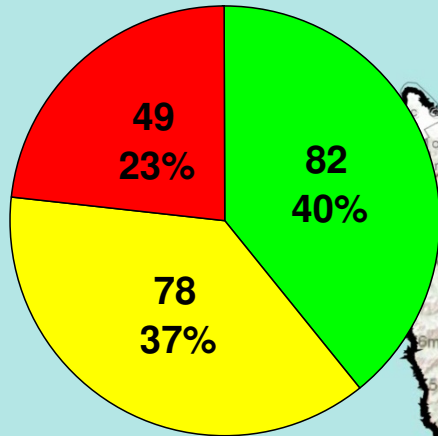
Data Source: State of California Department of Public Health

* Snow, Mills, and Zidar, June 1988. "Nitrates in Ground Water, Salinas Valley, California."

Salinas Groundwater Basin – Northern Region

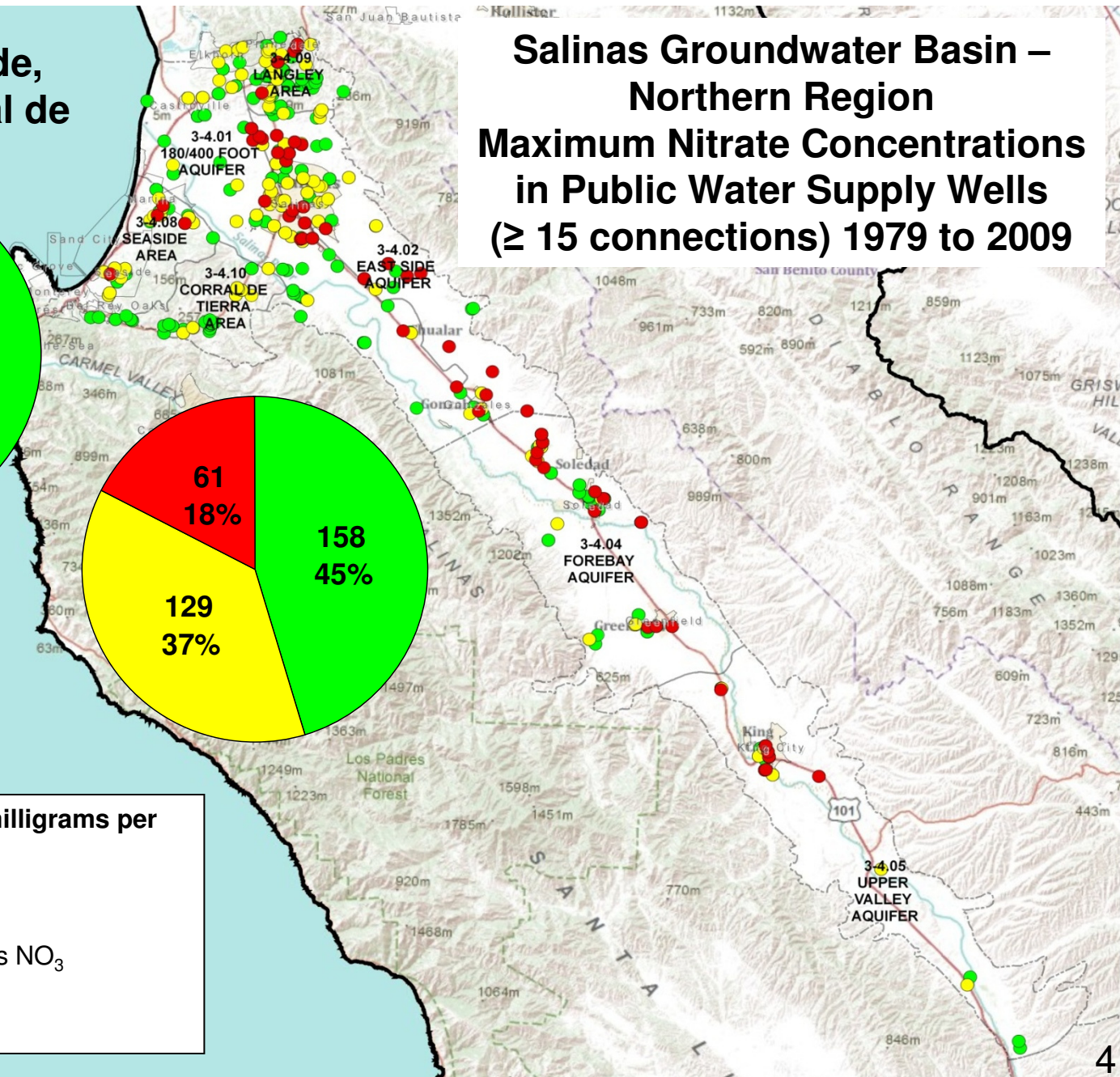
Maximum Nitrate Concentrations in Public Water Supply Wells (≥ 15 connections) 1979 to 2009

Excluding Seaside, Langley and Corral de Tierra areas

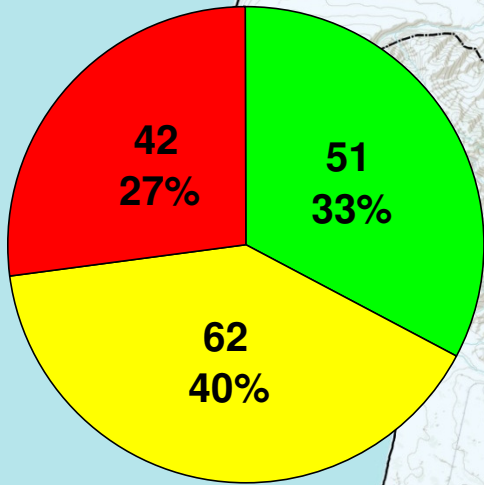
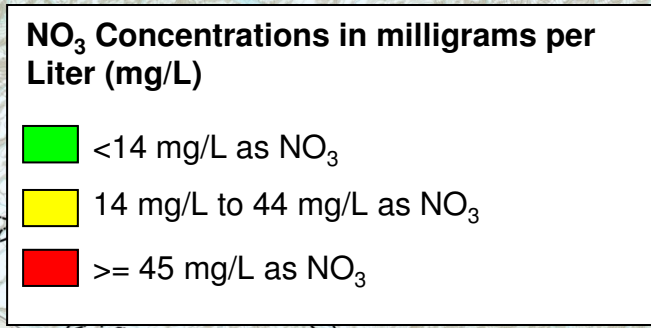


NO₃ Concentrations in milligrams per Liter (mg/L)

- < 14 mg/L as NO₃
- 14 mg/L to 44 mg/L as NO₃
- ≥ 45 mg/L as NO₃

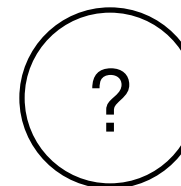
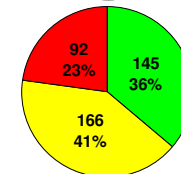
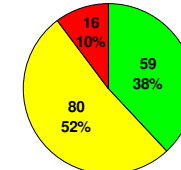
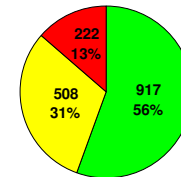


Santa Maria Groundwater Basin Maximum Nitrate Concentrations in Public Water Supply Wells (≥ 15 connections) 1984 to 2009

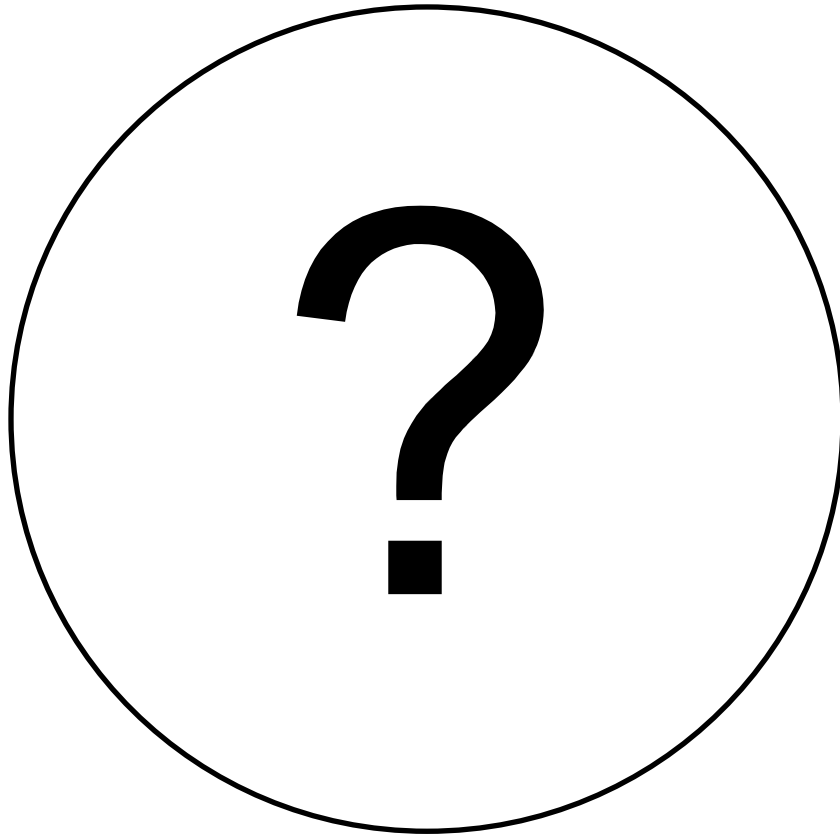


Drinking Water Supply Systems Monterey County

Connections	% > MCL for Nitrate
>14	13
5-14	10
2-4	23
1	?

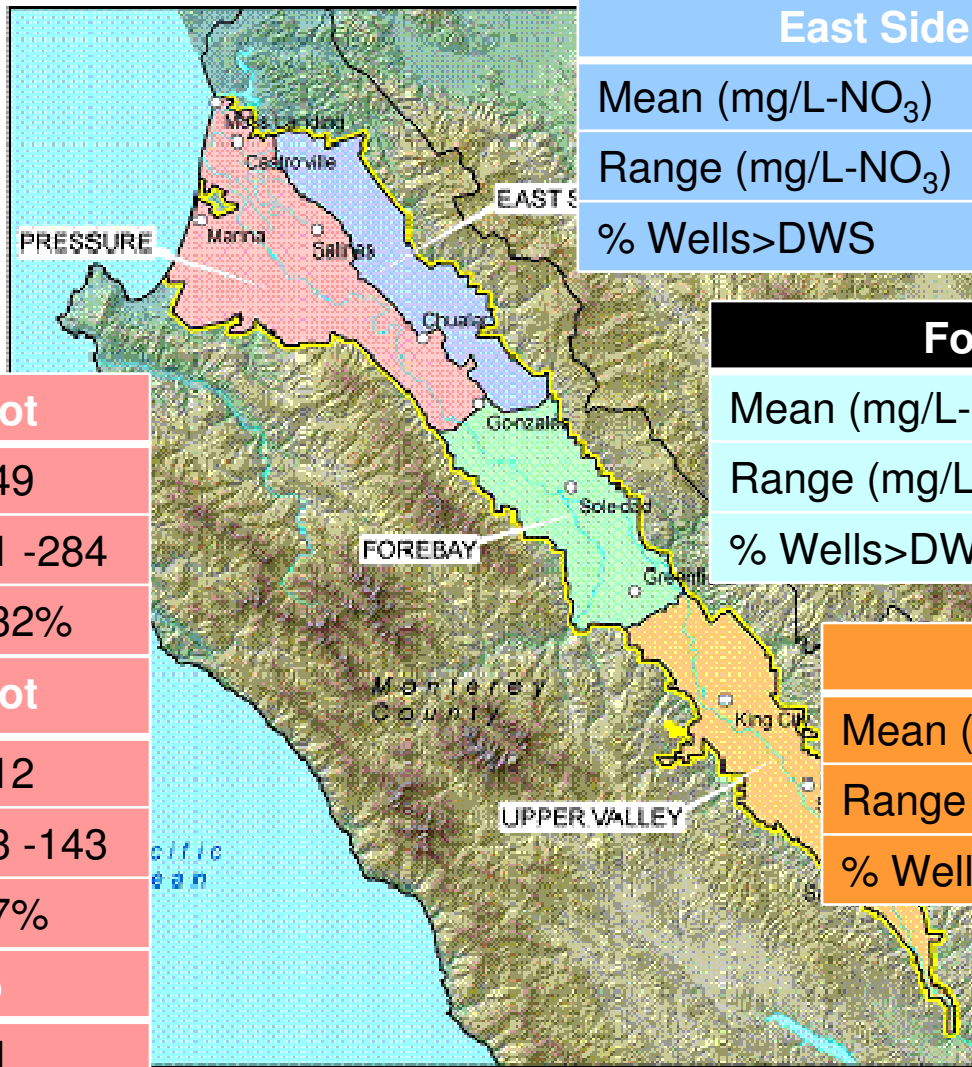


Domestic Wells



- 44,000 domestic wells in the Central Coast Region
- GAMA Domestic Well Study (Tulare)
- Santa Clara Valley Water District domestic well study

Agricultural Irrigation Well Nitrate Data (2007)



East Side	
Mean (mg/L-NO ₃)	106
Range (mg/L-NO ₃)	3 -502
% Wells>DWS	60%

Forebay	
Mean (mg/L-NO ₃)	79
Range (mg/L-NO ₃)	1 -290
% Wells>DWS	54%

Upper Valley	
Mean (mg/L-NO ₃)	90
Range (mg/L-NO ₃)	3 -425
% Wells>DWS	68%

Pressure/180 Foot	
Mean (mg/L-NO ₃)	49
Range (mg/L-NO ₃)	1 -284
% Wells>DWS	32%

Pressure/400 Foot	
Mean (mg/L-NO ₃)	12
Range (mg/L-NO ₃)	3 -143
% Wells>DWS	7%

Pressure/Deep	
Mean (mg/L-NO ₃)	1
Range (mg/L-NO ₃)	1 -2
% Wells>DWS	0%

Hydrologic Subareas within Agency Zones

- Agency Zones 2, 2A, and 2B
- City
- Water Body

Monterey County Water Resources Agency

Map Date: September 26, 2008

May 12, 2010

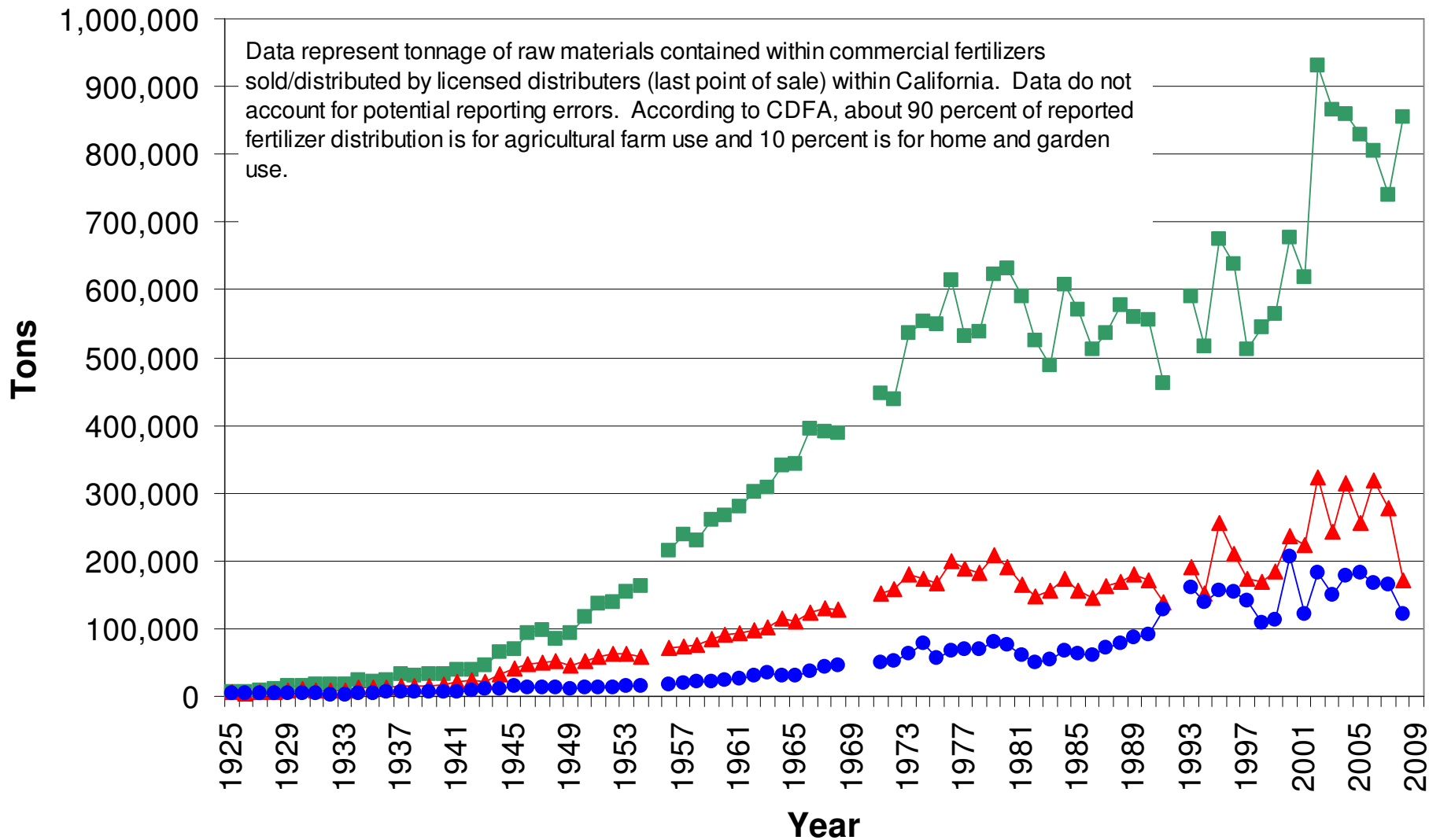
Salinas Valley Case Study

- 12 acre disposal area.
- Average daily disposal flow of 30,220 gal/day
- Effluent contains less than 2 mg/L-NO₃
- Shallow groundwater monitoring wells contain up to 300 to 500 mg/L-NO₃



May 12, 2010

California Department of Food & Agriculture (CDFA) Fertilizing Materials Inspection Program Tonnage Data - California

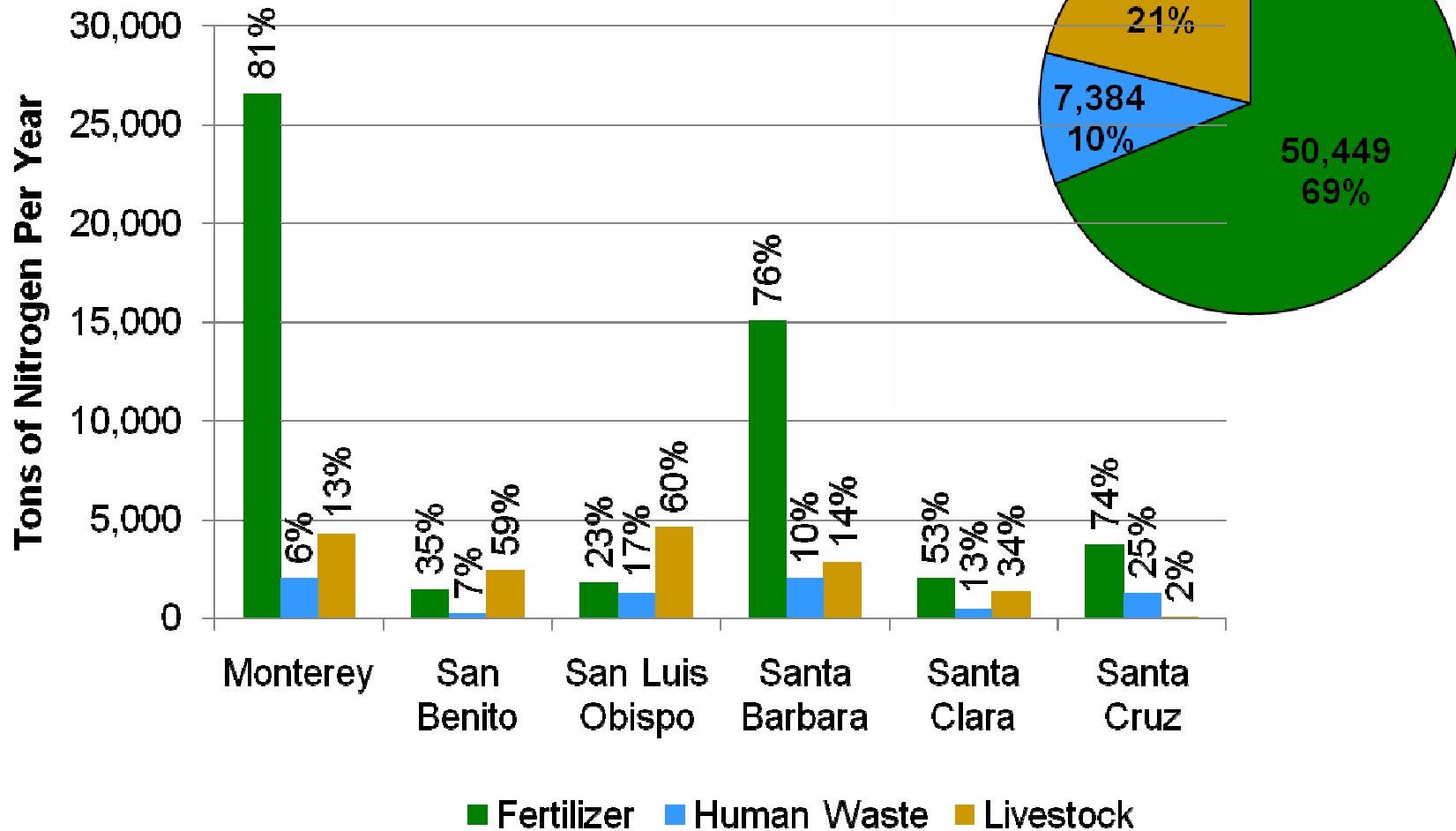


■ Nitrogen (N)
 ▲ Phosphorus (P₂O₅)
 ● Potassium (K₂O)

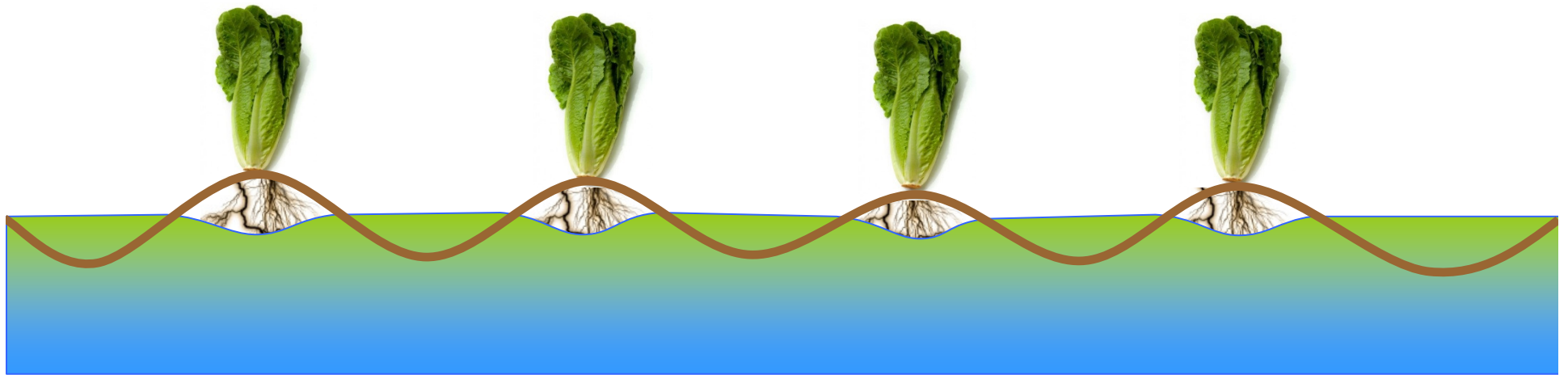
Relative Gross Available Nitrogen for the Three Largest Sources

Entire Region (tons/year)

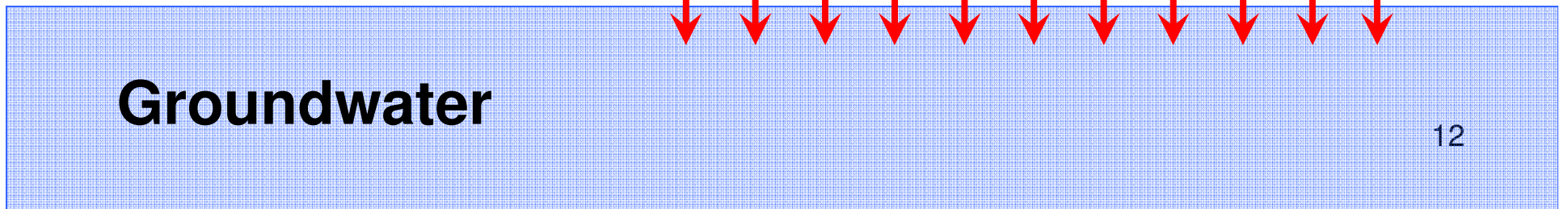
By County



Fertilizer Nitrate Loading to Groundwater



75,427 tons of nitrate per year



Estimated Amount of Nitrate from Fertilizer going into Groundwater in the Salinas Valley

Tons/year	1978 AMBAG Study	Current Estimate
Nitrate into Groundwater from Fertilizer	37,665	39,702

Domestic Water System Costs

- Under the sink-type Reverse Osmosis System: \$800 (avg.) plus \$100 per year for maintenance
- Typical cost for bottled water for 4 person household : \$350/year
- Average cost to install a new replacement shallow domestic supply well: \$7,200
- Domestic well ion exchange treatment system:
 - Capital cost: \$32K to \$250K
 - Annual Operation and maintenance: \$3.5K to \$32K

Public Water System Costs

- San Jerardo: \$17K monthly treatment costs and estimated \$4 million for new water supply well
- California Water Service Company (six Salinas valley public water supply wells)
 - Average monthly operation and maintenance costs: \$82K to \$174K
- New municipal water supply well: \$455,384 (2003)
- Morro Bay reverse osmosis System: \$1.5 million
- Small public water system well ion exchange treatment:
 - Capital Cost: \$192K to \$352K
 - Annual operation and maintenance: \$36K to \$40K

Social & Institutional Costs

- Human health
 - Blue Baby Syndrome
 - cancer, thyroid inhibition, Parkinson's, diabetes, endocrine system disruption
- Bond measures
 - tax dollars
- Fees & Surcharges
 - water or sewer bills

Conclusions

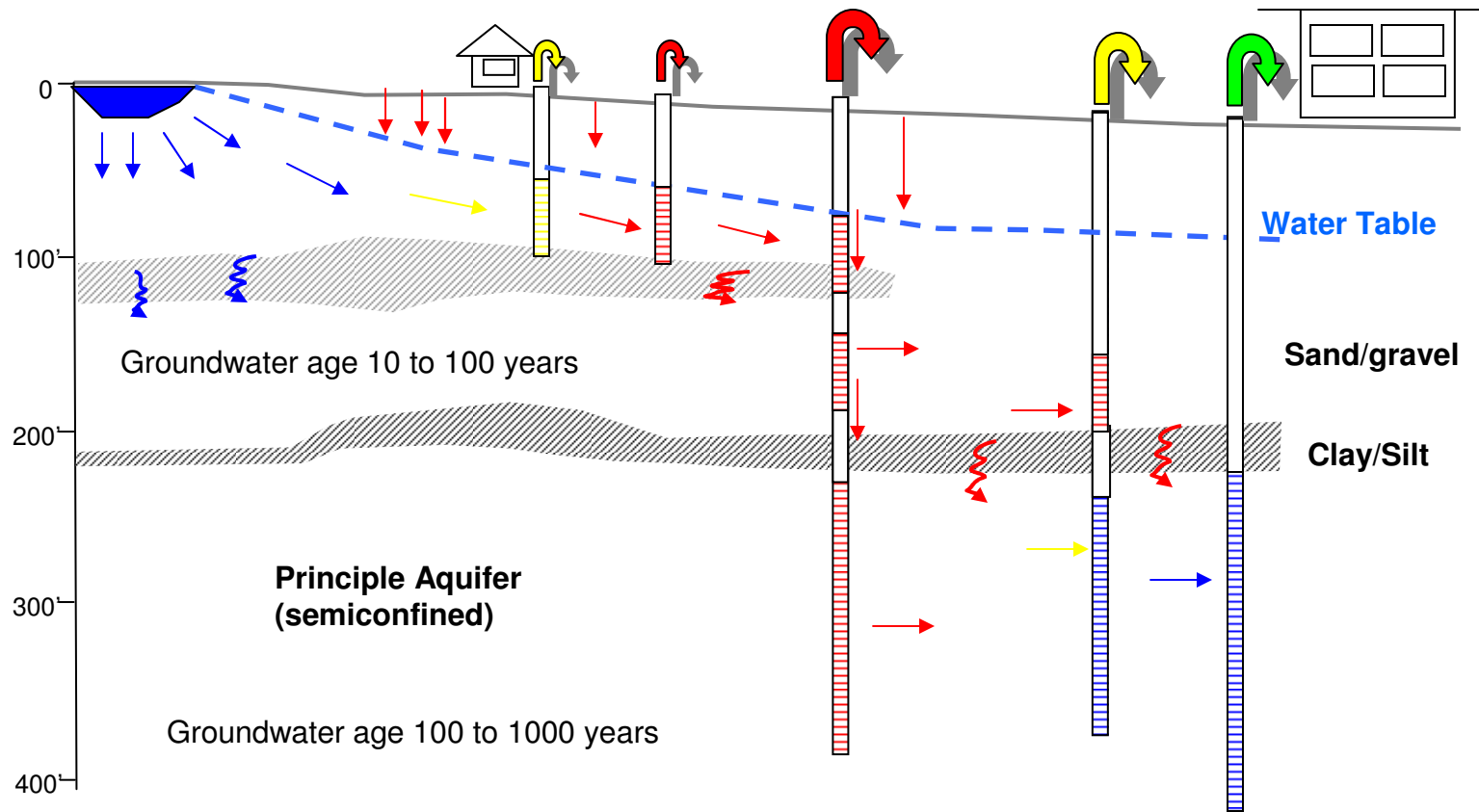
- Nitrate impacts to drinking water supplies are severe and widespread
- Nitrate loading to groundwater from agriculture is ongoing and significant
- Public health threat is significant
- Costs associated with nitrate impacts are significant
- Drinking water beneficial use protection

Section 116270(a) of the California Health and Safety Code

**Every citizen of California has the right to
pure and safe drinking water.**

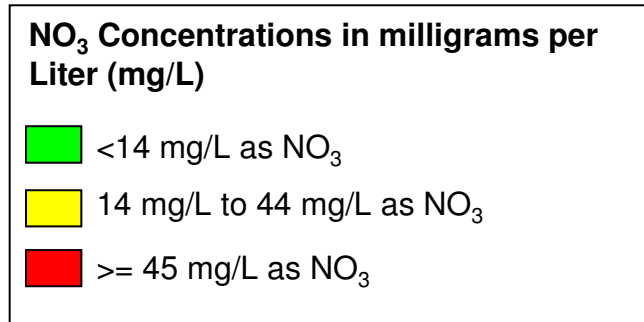
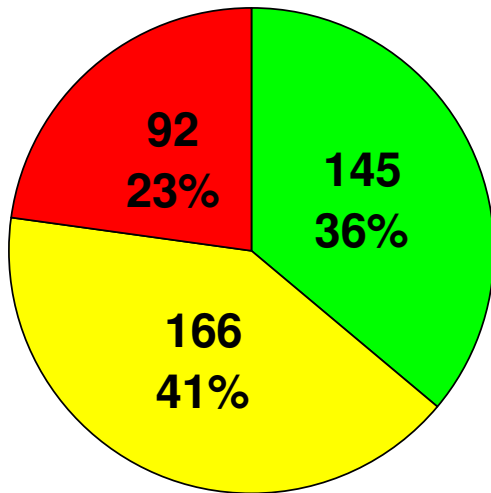
Irrigation, domestic and small water system wells

Deeper municipal/public supply wells

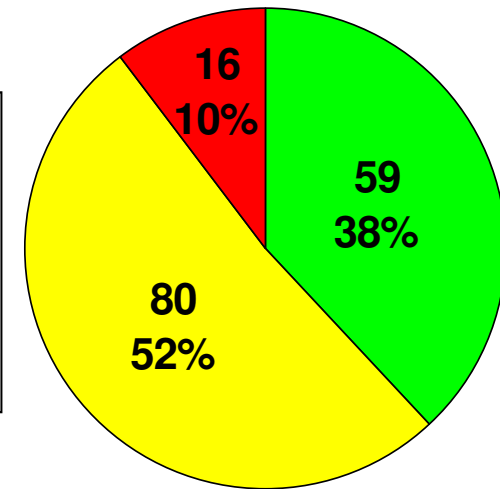


Small Water Supply Systems Monterey County 2008/2009

Local Small Water Supply Systems
(2 to 4 connections)



State Small Water Supply Systems
(5 to 14 connections)



- 403 (59%) of 687 systems sampled
- Max 327 mg/L
- Average of 34 mg/L

- 155 (55%) of 280 systems sampled
- Max 299 mg/L
- Average of 26 mg/L



Monterey County Water Resources Agency

2007 Summary of Nitrate (as NO₃) Concentrations for 152 Water Quality Study Wells in the Salinas Valley, Monterey County, CA

Hydrologic Subarea	Number of Wells Sampled	Mean Nitrate as NO ₃ (mg/L)	Median Concentration Nitrate as NO ₃ (mg/L)	Minimum Concentration Nitrate as NO ₃ (mg/L)	Maximum Concentration Nitrate as NO ₃ (mg/L)	Number of Wells Greater than DWS*	Percent of Wells Greater than DWS*
Pressure 180-Foot Aquifer	28	49	20	1	284	9	32%
Pressure 400-Foot Aquifer	44	12	3	1	143	3	7%
Pressure Deep Aquifer	5	1	1	1	2	0	0%
Pressure All	77	25	3	1	284	12	16%
East Side	15	108	63	3	502	9	60%
Forebay	41	79	54	1	290	22	54%
Upper Valley	19	90	78	3	425	13	68%
Locations Without 400-ft and Deep	103	77	47	1	502	53	51%
All Locations	152	56	20	1	502	58	37%

Data Source: Monterey County Water Resources Agency, June 10, 2009.

The majority of wells represented in this summary table are agricultural production wells.

*DWS-Drinking Water Standard

Estimated Loading of Nitrate to Groundwater in the Salinas Valley

Source	1978 AMBAG Study		Current Estimate	
	tons/year	% Contribution	tons/year	% Contribution
Cropland	37,665	78.4	39,702	81.5
Feedlots	7,473	15.6	4,626	9.5
WWTP	2,157	4.5	3,041	6.2
Dairies	346	0.7	121	0.2
Septic Tanks	270	0.6	1,264	2.6
Others	115	0.2	--	--